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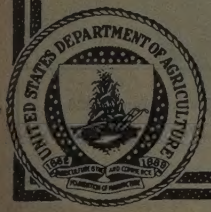
LICE, MANGE, AND TICKS OF HORSES AND METHODS OF CONTROL AND ERADICATION



THE THREE KINDS of animal parasites commonly found on the skin of horses in the United States are lice, mange mites, and ticks. All three kinds may be present on an animal at the same time.

One species of sucking lice and two species of biting lice affect horses. Both kinds are injurious, but they can be eradicated by spraying or dipping the infested animals twice, with an interval of from 14 to 16 days between treatments. Efficacious dips for lice are the arsenical, coal-tar creosote, and nicotine dips. *It is advisable to eradicate lice by dipping in the fall before cold weather makes it difficult or impossible.*

Mange is one of the most injurious skin diseases that affect horses. The three kinds that are of importance to the industry are sarcoptic, psoroptic, and chorioptic mange. Sarcoptic or common mange is the most injurious, and it is the most difficult to eradicate. Four or more dippings at intervals of from 5 to 7 days usually eradicate the disease. Lime-sulphur dip and nicotine solution are efficacious remedies. Two dippings from 10 to 12 days apart in any of the above-named dips will eradicate the other two kinds of mange.

Many different kinds of ticks affect horses, but the spinose ear tick is the only species for which specific remedies are discussed in this bulletin. A mixture of 2 parts pine tar and 1 part cottonseed oil injected into the ear canal of an infested horse will destroy ear ticks.

The instructions given for treating horses for external parasites apply equally well in the treatment of mules and asses.

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LICE, MANGE, AND TICKS OF HORSES, AND METHODS OF CONTROL AND ERADICATION

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CONTENTS

	Page		Page
Horse lice	1	Treating horses for external parasites	16
Horse mange	5	Dips for horses	18
Ticks	12	Dipping vats	22

HORSE LICE

EACH SPECIES of domesticated animal has its own peculiar kinds of lice, and horse lice will not live on animals other than horses, mules, and asses. Three kinds of lice are commonly found on horses in the United States. The first and most important of these is the bloodsucking species known technically as *Hæmatopinus asini.* The two other species, *Trichodectes pilosus* and *Trichodectes parumpilosus,* are biting lice.

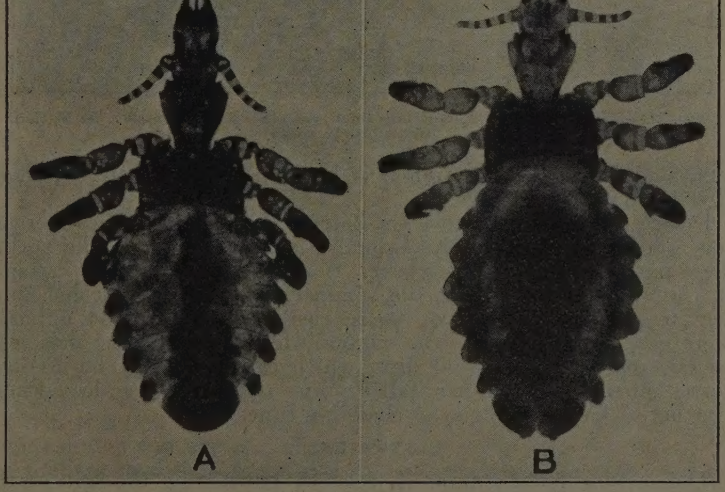

FIG. 1.—Sucking louse of horses (*Hæmatopinus asini*). A, male; B, female. (Magnified 25 times)

The sucking louse of the horse is easily distinguished from the biting species. It is much larger, and has a long, pointed head, whereas the biting lice have short, blunt, rounded heads. (Figs. 1 and 2.)[1] The sucking louse apparently causes more damage than the biting lice, and it is more difficult to eradicate.

NATURE AND HABITS

The eggs or "nits" of the sucking louse are attached firmly to the hairs, usually close to the skin, and they hatch on the animal in from 11 to 20 days, the majority hatching in from 12 to 14 days. The young lice reach maturity and the females begin laying eggs when they are 11 or 12 days old. The lice pass their life on horses, and can live only about 2 or 3 days when off a host animal.

The biting lice of horses deposit their eggs in the same general manner as the sucking louse. The period of incubation is probably from 8 to 10 days. These lice may live as long as 10 days when

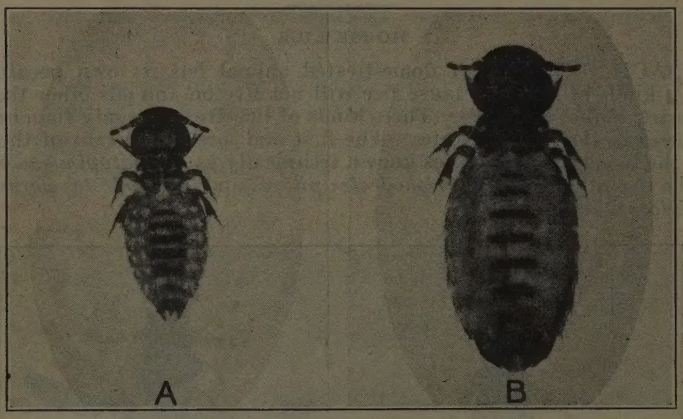

FIG. 2.—Biting louse of horses (*Trichodectes pilosus*). A, male; B, female. (Magnified 25 times)

separated from the host animal if kept on tufts of hair, but most of them die in 5 or 6 days.

During cold weather, when the hair on horses is long, lice increase very rapidly; but when the animals shed their hair in the spring these parasites seem to disappear. Some of the lice usually remain on the animals throughout the summer, but not in sufficient numbers to cause annoyance or to be easily detected. The animals, therefore, usually go into the winter infested. Since the most efficacious remedies are liquid dips, which can not safely be used on horses during cold weather, fall dipping should be practiced whenever horses have been lousy at shedding time.

SYMPTOMS

The sucking louse obtains its food by puncturing the skin of the horse and sucking blood and lymph. When not feeding it moves

[1] From photomicrographs by W. T. Huffman, of the Bureau of Animal Industry.

about on the hair and skin. The biting lice do not suck blood from the host, but apparently feed on particles of hair, scales, and exudations from the skin. The irritation and itching which result from either or both methods of feeding are shown by the efforts of infested animals to obtain relief. Infested horses rub and bite themselves, and often kick and stamp and manifest extreme uneasiness and irritation.

The coat becomes rough; the frequent rubbing destroys the hair in patches and often causes bruises or wounds in the skin. If lice are present in sufficient numbers to cause considerable itching and irritation they can usually be found, especially if the infested animal is placed in the sunshine. All species of horse lice are easily seen with the naked eye, and often congregate in groups or colonies on parts of the animal. The favorite locations are the sides of the neck, around the flanks, and under the jaws. In cases of gross infestation, however, lice may be found all over the body and legs.

When horses are lousy, close examination should be made to learn what kind or species of lice is present. It is not especially important, from a practical standpoint, to distinguish between the two species of biting lice, but it is important to know whether the animals are infested with biting or sucking lice or with both kinds.

METHOD OF SPREADING

More cases of infestation originate from direct contact with lousy animals than in any other way. Under reasonably good sanitary conditions stables, yards, and other premises which have contained lousy horses are not a source of great danger to horses free from lice. It seems probable, however, that occasionally lice may become dislodged from their host and drop on mangers, floors, etc., and from these locations find their way to a new host.

When separated from their host sucking lice live about 3 days, the biting lice not to exceed 10 days. Ordinarily eggs are not deposited except on the host, but when the hair to which they are attached is removed and kept under favorable conditions they may continue to hatch for as long as 20 days. The newly hatched lice live only 2 or 3 days unless they find a host. It is therefore possible for premises to remain infested for 25 or 30 days from the time they were occupied by infested horses When lousy horses are clipped the hair should be burned and the ground or floor where the clippings dropped should be thoroughly treated with an insecticide.

Lice may be carried from one animal to another on currycombs, brushes, and blankets, or by harness, saddles, and other equipment moved directly from a lousy horse to one free from lice. Currycombs and brushes should be treated each time a horse is groomed. Harness, saddles, blankets, and other equipment used on lousy animals should not be put on horses that are free from lice unless the equipment has been thoroughly cleansed.

When cleaning stables and yards remove all litter and manure down to a smooth surface, then spray well with a good insecticide. The coal-tar creosote dips, diluted in accordance with the instructions printed on the label of the container, are suitable for ridding premises of the lice.

TREATMENT

None of the dips recommended for use in treating horses can be depended on to eradicate lice at one dipping. The first dipping, if properly done, will probably kill all the lice, but it may not destroy all the eggs. The "nits" or eggs which survive dipping often hatch, forming a new generation of lice. This new generation should be destroyed by a second dipping after hatching is completed and before the young lice become mature and begin depositing eggs. Since these two periods overlap somewhat and vary greatly, and because the periods from hatching to egg laying are different for the sucking and biting lice, it is impossible on this basis to calculate the exact period that should elapse between dippings. Young lice appear on dipped animals as early as the third day after the first dipping, and since the average period of maturation is about 12 days it seems evident that the second dipping should be given in about two weeks. Experience has shown that two dippings with an interval of from 14 to 16 days can usually be depended on to eradicate both sucking and biting lice.

FIG. 3.—Fumigation with sulphur gas for lice. Eyes and nostrils must be kept away from the gas. Part of head not fumigated must be hand treated.

The dips commonly used for eradicating lice on horses, mules, and asses, named in the order of their effectiveness, are arsenical solution, coal-tar creosote, and nicotine. The arsenical solution is poisonous, and unless handled with due precaution injury to man and animal may result. When properly used, however, it is the most dependable known dip for eradicating lice. The coal-tar creosote dip is effective when used in reasonably good water. Two dippings, from 14 to 16 days apart, in either of these dips can usually be depended on to eradicate horse lice. Two dippings in nicotine solution will ordinarily free horses from lice. On

account of the difficulties in dipping in cold weather, and the unsatisfactory nature of hand treatments, most of them only palliative, it is advisable to dip for lice, when they are present, in the fall of the year before the onset of cold weather.

Hand applications of dusting powders and oils and greases are often resorted to in treating horses for lice. Some of the dusting powders are of value in holding the parasites in check, but as a rule they are not effective in eradicating sucking lice. Biting lice can be eradicated with sodium fluoride applied in the form of a powder or mixed with water in the proportion of about 1 ounce to 1 gallon; but it is not effective against sucking lice. Care should be taken not to apply sodium fluoride too freely around the natural body openings or where the skin is very thin and hairless, and not to rub it into the skin. It may be applied with a dust gun, or a shaker, or by hand.

Oils and greases, such as crude petroleum, crank-case oils, or equal parts of cottonseed oil and kerosene, are effective remedies for lice; but ordinarily they are not suitable for use on horses, as they cause the hair to come out, and they often blister the skin.

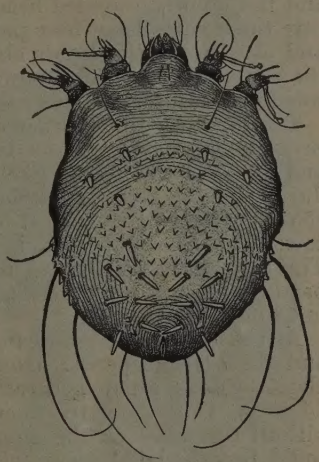

FIG. 4.—Sarcoptic mange mite. Female. (Magnified 100 times)

Fumigating horses with the fumes from burning sulphur (sulphur dioxide) will kill horse lice, but many of the eggs survive, and two treatments two weeks apart are necessary to effect eradication. The advantage of this method of treatment is that it can be used when the weather is too cold for dipping. The disadvantages are that it is necessary to have a gas-tight inclosure and the animal's eyes and nostrils must be kept away from the gas. A concentration of about 1 per cent sulphur dioxide is necessary to kill the parasites, and serious injury or death may result if the gas comes in contact with the eyes or nostrils. After fumigation it is necessary to hand treat that part of the head that was not fumigated (fig. 3).

HORSE MANGE

Scabies in horses, commonly known as mange, itch, or scab, is a name given to a group of contagious skin diseases caused by minute parasites known as mites, which live on or in the skin. Four species of these parasites are found on domesticated animals, but horses are commonly affected by only three of them. These parasites are classified zoologically in three different genera—*Sarcoptes*, *Psoroptes*, and *Chorioptes*. Mites of the first two genera are shown in Figures 4 and 7.

In obtaining their food from the host and preparing a resting place in or on the tissues, the mites cause wounds or lesions in the skin. As each kind of mite possesses distinctive habits, the location

and nature of the lesions in the early stages are more or less characteristic. Each kind of mite, therefore, causes a specific kind of mange which is named after the generic name of the mite. Thus we have in horses sarcoptic, psoroptic, and chorioptic mange. The sarcoptic variety is the one most common on horses in the United States.

SARCOPTIC MANGE

SARCOPTIC MANGE MITE

The mites which cause sarcoptic or common mange of horses are small, white, or yellowish parasites known technically as *Sarcoptes scabiei equi* (fig. 4). The female when full grown measures about one-fiftieth and the male about one-sixtieth of an inch in length. When placed on a dark background they are visible to the naked eye. The general form of the body is more nearly round than oval, and the bluntly rounded head is as broad as it is long. When mature these mites have four pairs of short, thick legs, the fourth pair and usually the third pair also not extending beyond the margin of the body. Under a high-power microscope a number of short, backward-projecting spines may be seen on the upper surface of the body.

The sarcoptic mites penetrate the upper layer of the skin and excavate burrows or galleries in which the mating of the sexes occurs and the eggs are laid. Each female may lay from 10 to 25 eggs during the egg-laying period, which probably lasts from 12 to 15 days. When that period is completed the female dies in her burrow. The entire life cycle is passed on the body of the host animal. The eggs hatch in from 3 to 10 days, and the young mites after passing through several molts reach maturity and begin laying eggs in 10 or 12 days.

As the average period of incubation on the animal is about 4 days, and the average period after hatching until egg laying begins is about 11 days, a new generation of mites may be produced in about 15 days. If the first treatment or dipping could be depended on to kill all the mites on the animal the time for the second treatment could be calculated accurately. Unfortunately, the first treatment usually does not kill all the sarcoptic mites on the animal because of the difficulty of getting the dip or other insecticidal substance into the burrows and in contact with the mites. Practical experience has shown that the interval between treatments or dippings should be from five to seven days.

SYMPTOMS

In the early stages of sarcoptic mange in horses the first visible lesions usually occur on the neck or shoulders or around the head, but the disease may start on the breast, flanks, sides, or other parts of the trunk. From these parts the disease spreads until the entire surface of the body may become involved.

The mites penetrate the upper layer of the skin, each female making a separate burrow or gallery, which usually extends to the sensitive tissues or "quick." The presence and activities of the mites on the sensitive tissues cause great irritation and itching, and the skin becomes inflamed and swollen, so that small nodules are formed over and around the burrows. As the disease developes vesicles are formed which break and discharge serum. As the serum dries,

small scabs are formed, and the hair over the affected parts stands erect and some of it drops out. In some cases the affected areas of skin become dry and scurfy, and may have a leatherlike appearance (fig. 5).

The mechanical injury to the skin resulting from rubbing and biting causes large scabs to form, which adhere firmly to the underlying tissues. The large scabs often are broken by the movements of the animal, and blood or serum may stain the scabs a reddish yellow.

As the disease advances the skin becomes more or less bare in irregular-shaped, bald patches, and is greatly thickened and thrown

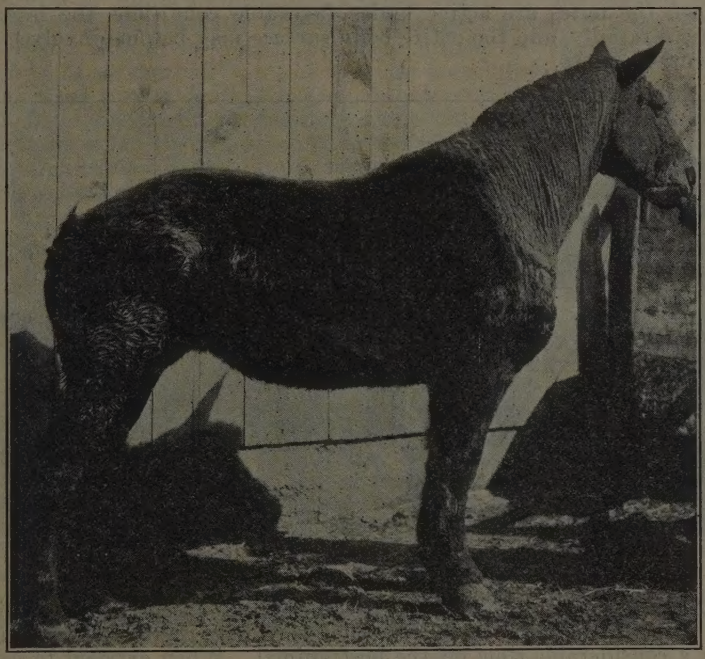

FIG. 5.—Sarcoptic mange. Head, neck, and shoulders involved

into wrinkles or folds (fig. 6). In severe cases the horse loses flesh rapidly, becomes greatly weakened, and unless properly treated may die.

CONTAGIOUSNESS

Sarcoptic mange is transmissible from one species of animal to another, and also from animals to man. Ordinarily when one species of animal contracts the contagion from another species the mites live only a limited time on the new host. Sarcoptic mites of the sheep, hog, camel, dog, cat, and rabbit may live on horses, and those of the horse, dog, and hog are known to be readily transmissible to man.

Sarcoptic mange of horses is contagious to all classes of horses, and is usually transmitted by direct contact with infested animals. It may, however, be transmitted by other objects, such as currycombs, blankets, or harness, or in stables or other premises. It is important that mangy horses be isolated and all equipment kept separate until the disease is eradicated.

Apparently the disease spreads slowly during warm weather, especially among horses on pasture, but it makes rapid headway in horses closely confined or crowded together in small inclosures. Exposure to cold, inclement weather, insufficient feed or poor quality, or any other circumstance tending to lessen the vitality or functional activities of horses hastens the spread and development of mange. When the mites are active under favorable conditions the lesions extend rapidly, and the entire body surface may become involved in about six weeks.

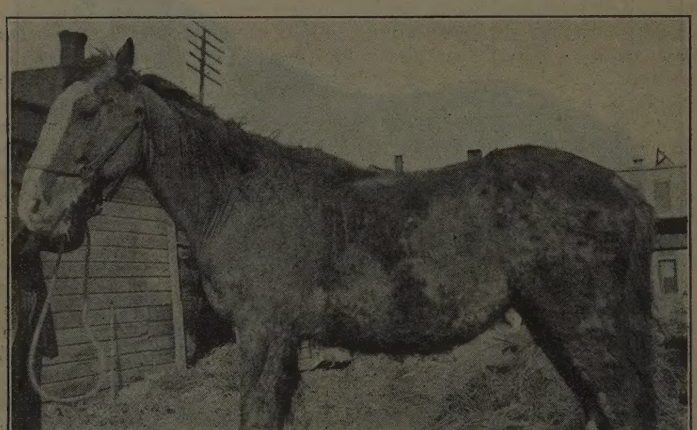

FIG. 6.—A well-advanced case of sarcoptic mange

Although they do not propagate themselves except on the bodies of animals, the mites as well as their eggs may retain their vitality for a considerable time off the host animal. When exposed to sunlight in dry places the sarcoptic mites live only a few days, but in moist, protected places they may live three weeks or even longer. Although it is difficult to infect horses experimentally from infested premises, the possibility that the disease may be contracted from such sources should not be overlooked. It is good sanitary practice to clean and disinfect all stables and small inclosures which have been occupied by mangy horses, also all currycombs, brushes, blankets, and other objects used on such horses, before using them for clean animals. Cleaning and disinfecting for sarcoptic mange may be done in the same manner as for lice.

TREATMENT

On account of their burrowing habits, sarcoptic mites are difficult to eradicate. The common dips, such as lime-sulphur, nicotine, and coal-tar creosote, will kill sarcoptic mites if the dip can be brought into direct contact with the parasites. This method, however, requires thorough, frequent, and persistent applications. From four to six dippings, five to seven days apart, in lime-sulphur or nicotine solution will usually effect a cure in ordinary cases, especially if all affected areas are soaked well with warm dip and scrubbed with a brush just prior to the first dipping. Affected animals should be held in the bath from two to three minutes.

Two or more applications, a week apart, of unprocessed crude petroleum will usually eradicate sarcoptic mange, if treatment is applied before the disease becomes chronic. Crude oils, however, often cause the hair to come out and may blister the skin. Crude oil is not a suitable dip for common use on horses, but it is of value in hand treatment for holding mange in check during the winter months when the temperature is too low for dipping. Crank-case drainings may be substituted for crude petroleum, but such oils also cause loss of hair and often blister the skin.

Fumigation of mangy horses with sulphur dioxide has been recommended by some European investigators. The Bureau of Animal Industry has conducted some field tests with this method of treatment, but the equipment and methods of application so far devised are too complicated and expensive for general use except where large numbers of horses are assembled for treatment under the supervision of a veterinarian. Apparently this method of treatment has no distinct advantage over dipping except that it can be used when the temperature is too low for dipping. In applying home treatment or fumigating for mange the medicament has a better chance of reaching the parasites if the hair over and around the lesions is first clipped and singed.

Cases of sarcoptic mange of long standing, which have been neglected and allowed to develop until the affected skin has become greatly thickened and leatherlike, are usually incurable by any ordinary method of treatment. In cases of suspected mange prompt and vigorous action should be taken, as the disease can be eradicated in the early stages at comparatively low cost.

PSOROPTIC MANGE

PSOROPTIC MANGE MITE

The mite (*Psoroptes communis equi*) which causes psoroptic mange lives on the surface of the skin and does not form burrows. Psoroptic mites are slightly larger than sarcoptic mites, the mature female measuring about one-fortieth and the male about one-fiftieth of an inch in length (fig. 7). The entire life cycle is passed on the host animal. Each female may deposit from 15 to 24 eggs, which hatch in 3 to 4 days. The young mites reach maturity, mate, and the female deposits eggs in from 10 to 12 days.

Dipping, if properly done, kills all psoroptic mites, but can not be depended on to destroy the eggs. Some of the eggs may hatch after

dipping, thus forming a new generation of mites. To effect eradication it is necessary to give a second dipping after hatching is completed and before the young mites reach maturity and begin laying eggs. It is evident that the interval between the first and second dippings should be from 10 to 12 days.

SYMPTOMS

Psoroptic mange may start on any part of the body covered thickly with hair, but the first lesions usually appear on the head under the foretop, on the top of the neck around the mane, or on the rump. From the starting point the disease spreads slowly over the body.

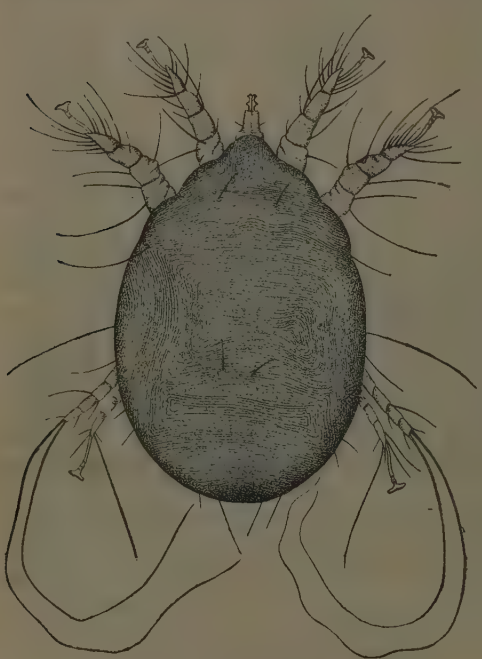

FIG. 7.—Psoroptic mange mite. Female. (Magnified 100 times)

The mites prick the skin and probably introduce a poisonous secretion into the wound. A slight inflammation is caused, accompanied by an intense itching. In the early stages of the disease the lesions are not sufficiently prominent to attract attention, but the animals rub and bite themselves to relieve the intense itching, and these symptoms should always be investigated to learn the cause.

As the mites multiply, large numbers of small wounds are made in the skin, followed by the formation of papules, increased inflammation and itching, and the exudation of serum. The serum which oozes to the surface becomes mixed with foreign matter and microorganisms, and this mass soon hardens into yellowish or gray-colored scabs. The scabs are frequently stained with blood. In the early stages the hairs around the lesion may be glued together in a small clump and the nodule or scab may be about the size of a pea. As the mites constantly seek the healthy skin around the edges of the wound, the scab or lesion gradually increases in size.

Some of the mites migrate to other locations and start new lesions, which extend until they cover large areas. As the disease advances the skin becomes thickened, tumefied, and thrown into wrinkles or

folds. Large areas become denuded of hair and covered with thick, adherent scabs. When the disease reaches this stage it is difficult to differentiate it from sarcoptic mange.

Itching is intense and irritation continues throughout the course of the disease. The skin becomes bruised and raw from the reckless rubbing against any available surface. The uniform thickening and hardening of the skin is characteristic of mange, but the most certain diagnosis consists in finding and identifying the mite which causes the disease. In the early stages of psoroptic mange the mites may usually be found in scrapings taken with a blunt-edged knife from around the edges of fresh lesions. In the advanced stages scrapings taken from the edges of scabs or from the bottoms of the folds of skin may contain mites.

In the early stages psoroptic mange may be distinguished from sarcoptic mange by the character of the lesions and the manner of spreading, but the most dependable diagnosis consists in finding the mite. For practical purposes where facilities for examination are limited the principal differences in form and structure of the two species of mites may be summarized thus: The sarcoptic mite is slightly smaller than the psoroptic mite, and the body of the former is more nearly round than oval (fig. 4). Adults of both species have four pairs of legs, those of the psoroptic mites being long, and all four pairs extend beyond the margin of the body (fig. 7). The sarcoptic mites have shorter legs, and the fourth or hind pair and usually the third pair do not extend beyond the margin of the body. The head of the common scab mite is tapering or cone-shaped and is longer than it is broad, whereas that of the psoroptic variety is bluntly rounded in front and is as broad as it is long.

It is advisable to examine several specimens in all cases, because under low-power magnifying glasses the females of the two species are more easily distinguished from one another than the males. On account of the burrowing habits of the sarcoptic mites, they are difficult to find, especially in the early stages of the disease. They are situated in burrows under conical papillæ, and by scraping the infested area until the blood oozes from the tissue, the mites sometimes may be found in the scrapings.

CONTAGIOUSNESS

Each species of domesticated animal has its own peculiar variety of psoroptic mange, and the variety which lives on the horse, ass, or mule is not transmissible to other animals, with the possible exception of the camel. The disease is more highly contagious to all classes of horses than sarcoptic mange. The predisposing causes, manner of spreading, carriers of the mites, and precautions to be observed in isolating infected animals and cleaning and disinfecting premises are practically the same as for sarcoptic mange.

TREATMENT

As the psoroptic mites live on the surface of the skin, they are more easily eradicated than the sarcoptic variety. The remedies

recommended for sarcoptic mange are effective in eradicating this disease. Two dippings from 10 to 12 days apart may usually be depended on to cure ordinary cases. Four or more dippings may be necessary in chronic cases.

CHORIOPTIC MANGE

Chorioptic or symbiotic scabies, commonly known as foot mange, is caused by a mite (*Chorioptes equi*) which closely resembles the psoroptic mite. Chorioptic mites live on the surface of the skin and produce lesions similar to those of psoroptic mange.

The lesions of chorioptic mange are usually confined to the lower part of the limbs around the foot and fetlock. Occasionally the mites spread over the legs above the hocks, and may reach even the thighs and abdomen, but usually the disease remains localized around the feet.

Infested animals paw and kick, and rub the pastern with the opposite foot, and often try to bite the affected parts. Some of the hair comes out and the skin has the thickened and hardened condition characteristic of scabies.

The remedies recommended for sarcoptic mange are effective in eradicating foot mange. The affected areas should be well soaked in warm lime and sulphur dip, and the treatment repeated every 10 days until a cure is effected. To drive the horses through a shallow wading tank filled with dip is a quick and effective method of treatment for foot mange.

TICKS

There are many different kinds of ticks which may attack horses, but since the habits and life cycles of the different species vary greatly, discussion in this bulletin is necessarily limited to general information except for the ear tick, which is discussed more fully.

When only a few ticks are found on horses they may be removed by hand or covered with crude petroleum, cylinder oil, kerosene, or other oil, which usually causes them to detach and drop to the ground. In removing ticks by hand the writer has observed that they may sometimes be detached without leaving the head embedded in the skin by twisting them around as they are pulled loose.

In the southern and western parts of the United States it is not uncommon for horses to become grossly infested with ticks. In some sections of the country the infestation may occur only infrequently; in others it may occur more or less regularly each year. In the region infested with cattle-fever ticks where eradication work is in progress, tick-infested horses are dipped in arsenical solution to kill the parasites.

In any region where the horses become infested with ticks and the infestation is extensive the State livestock sanitary authorities should be notified in order that the ticks may be identified and proper measures taken for control. Control or eradication methods, to be successful, must be based on a knowledge of the life history and habits of the tick involved.

SPINOSE EAR TICK

NATURE AND HABITS

The spinose ear tick (*Ornithodoros mégnini*) is prevalent on horses in the Southwest and causes serious damage to the livestock industry. Spinose ear ticks (fig. 8) enter the ears of animals as small, six-legged seed ticks and attach themselves in the external canal well below the hair line, where in a week or two they become engorged larvæ. The engorged larvæ molt to form nymphs or young ticks having eight legs. The young ticks remain in the ears from one to seven months, or until fully grown and engorged, when they drop to the ground, crawl up into dry, protected places above the ground, and again molt. The skin of the nymph is covered with spines, but that of the mature tick is smooth. So far as known the adult tick does not attach itself to animals nor does it take food. Mating and egg laying take place off the animal, and when egg laying is completed the female dies. The eggs may hatch as early as 10 days after they are laid. Shortly after hatching the seed ticks are ready to attach themselves to any suitable host. They may live as long as three months if no host is found.

SYMPTOMS

When animals are grossly infested and the ear canals packed full of ticks the parasites are visible on superficial examination, but when

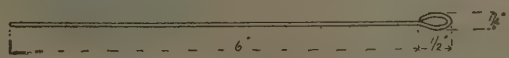

FIG. 9.—Ear probe made of bailing wire

the degree of infestation is light or moderate the ticks may be overlooked. They usually attach themselves in the deep folds of the ear or crawl into the ear canal and follow it inward, sometimes as far as the eardrum. As the ticks increase in size and others enter, they and the excretions, with the wax from the ear, accumulate in masses or plugs sufficient in some cases to close up the ear passages completely. These conditions give rise to various symptoms. The infested animal usually shakes its head and repeatedly turns it from side to side, meanwhile inverting, or turning down, first one ear and then the other. When irritation and itching are more intense on one side the animal often turns its head so that the more seriously affected ear is held downward. There is a tendency to rub and scratch the ears, and young animals often run as though endeavoring to relieve the nervous tension.

In all cases where ear-tick infestation is suspected the animals should be examined, and if no ticks are visible the ears should be probed. A convenient and effective instrument for probing the ears, removing ticks from the ear canals, and breaking down masses of ear wax and ticks may be made from a piece of ordinary baling wire, as shown in Figure 9.

FIG. 8.—*A*, ear ticks and débris from ear of animal (about natural size). *B*, engorged larva (magnified 5 times). *C*, young tick (magnified 5 times). *D*, partially engorged young tick (magnified 5 times). *E*, fully engorged young tick (magnified 5 times). *F*, adult female (magnified 5 times). *G*, adult male (magnified 5 times)

TREATMENT

Complete eradication of spinose ear ticks is a difficult matter, on account of the habits and great vitality of the ticks and the wide range of animals which they may infest. Results of investigations conducted by the Bureau of Animal Industry have shown that dipping in any of the known dips or the injection into the ear passages of bland oils, crude petroleum, or various dips, etc., is not effective in killing the ticks or causing them to leave the ears. Gasoline and kerosene when applied undiluted kill the ticks, but cause blistering of the skin and are not suitable for use on horses. Chloroform, undiluted or mixed with a bland oil, is commonly used on horses and dogs and is effective. Such substances as chloroform evaporate rapidly, and therefore afford no protection against reinfestation.

The remedy for ear ticks formulated and thoroughly tested by the Bureau of Animal Industry consists of a mixture of 2 parts by volume of ordinary pine tar and 1 part by volume of cottonseed oil. In mixing the ingredients add the cottonseed oil to the pine tar and stir until a uniformly smooth mixture is obtained. When necessary the ingredients should be warmed before mixing, so that they will mix readily and flow freely. The mixture remains uniform without separation or deterioration, and may safely be used on any species of domesticated animal. Being of a sticky consistence, it remains in the ears and affords protection against reinfestation from 30 to 60 days. The only known effective method of applying treatment is to inject the remedy into the ear passages by hand.

Most horses oppose the insertion of anything into their ears, and some form of restraint is necessary. Gentle farm horses can usually be controlled with the twitch or other well-known methods of restraint, but in treating wild range horses special equipment is necessary. An ordinary crowding chute not more than 3 feet wide is suitable for treating horses for ear ticks.

An ordinary metal or hard-rubber syringe holding from 1 to 2 ounces is the best instrument to use for injecting the pine-tar-cottonseed-oil mixture. Have the mixture warm enough to flow freely, fill the syringe, grasp the ear with the left hand, then insert the nozzle into the opening of the ear canal and inject about one-half ounce of the fluid. Hold the ear in an upright position for a few seconds and manipulate to force the mixture into the deeper parts. If too much fluid is injected it will overflow and run down over the head and face, where it may cause blistering. The mixture causes very little irritation except on parts exposed to the direct rays of the sun.

When the ear passages contain masses of hard wax and ticks, such masses should be broken down and scraped out with a wire loop (fig. 9) before treatment is applied. Treatment should be applied as often as necessary to keep the ears free from ticks. One treatment properly applied can be depended on to kill all ticks in the ears and to prevent reinfestation for about 30 days. It should be remembered, however, that the eggs of the tick are not deposited or hatched in the ears of animals, and a new crop of seed ticks may find lodgment at any time on animals kept in infested places.

TREATING HORSES FOR EXTERNAL PARASITES

The three commonly used methods of treating horses, mules, and asses for external parasites are (1) hand applications, (2) spraying, and (3) dipping. A fourth method, not in common use but recommended by some European investigators, is fumigation with sulphur dioxide.

HAND APPLICATIONS

Infested animals may have parasites on any or all parts of the body surface, and to effect complete eradication usually it is necessary to cover the entire surface of the skin with the medicament. On account of the difficulty of applying treatment by hand over the entire body surface, hand applications are recommended only as a temporary measure for holding parasites in check until the animals can be dipped or sprayed.

SPRAYING

Common parasites on or in the skin can be eradicated by proper spraying, but the method commonly practiced is not economical. It is difficult to wet the hair coat of an animal with a spray, and much of the liquid runs off and is wasted. Spraying is not effective unless all parts of the skin and hair are well soaked.

An ordinary orchard-spraying outfit or a common hand pump equipped with hose and spray nozzle may be utilized for spraying animals.

DIPPING

Dipping is the most effective known method of applying treatment for common external parasites. Dipping plants are so arranged that the animals are immersed in liquid deep enough to swim in, and the entire body surface is well soaked. For dipping horses the dip in the vat should be kept at a depth of 70 to 80 inches, or sufficient to immerse completely the tallest animal to be dipped. Horses will carry out and retain from 2 to 4 quarts of dip each, and the depth of the liquid in the vat will be lowered accordingly. The total estimated quantity of dip which the animals carry out plus that required to charge the vat should equal the total quantity required, provided none is lost by leakage or otherwise wasted.

The capacity of the vat is usually obtained by multiplying, in terms of inches, the average length by the average width, then the product by the depth. This gives approximately the number of cubic inches of space to be filled with dip. Divide this by 231 (the number of cubic inches in a gallon), and the result will be the number of gallons of dip needed to charge the vat (fig. 10).

To obtain the average length, add the length at the bottom to the length at the dip line and divide by two. The average width is obtained in the same manner. The depth should be taken at the center of the vat and from the bottom to the dip line only, and not to the top. All measurements should be made only of the space to be filled with dip, and not above the dip line. The capacities of the various tanks are obtained by a like process.

Before dipping, the contents of the vat should be well stirred in order that the dip may be of uniform strength and temperature throughout. The pens, chutes, vat, etc., should be examined for projecting nails or any object that might puncture or wound the horses, as the dip may injure those having fresh wounds.

In dipping wild range horses it is necessary to have a gate or bar in the chute to prevent the animals from piling up in the vat. Horses should be watered and fed from two to four hours before dipping, and if heated by driving they should be allowed to cool off before entering the vat.

The head of each animal should be completely submerged for an instant at least once while in the vat. The head should not be held under, but quickly ducked with a dipping fork and released. Two duckings of the head are advisable, especially if the animals are affected with scabies. Care should be taken to see that the inner surface of the ear is well soaked.

In dipping for lice, it is not necessary to hold horses in the vat, but if they have scabies they should be held in the vat two or three minutes. After leaving the vat the animals should be held in the draining pens until all surplus dip has drained off their bodies (fig. 11). Dipping should be finished for the day early enough to dry the animals before sunset.

FIG. 10.—Dipping vat being filled with liquid

FUMIGATING

Fumigation consists in exposing animals to the fumes of burning sulphur (sulphur dioxide) or some other gas. The animals to be

fumigated are placed in a gas-tight chamber with the head projecting through an opening and the nose and eyes protected from the gas (fig. 3). This method is often recommended for treating animals for external parasites.

Investigations conducted by the Bureau of Animal Industry have shown that the present known methods of fumigating animals are not suitable for general use. The minimum effective concentration of sulphur dioxide for mange apparently is about 4 per cent and for lice about 1 per cent. Under ordinary conditions the concentration or per cent of gas in the air can not be raised to more than about 1.5 or 2 per cent by burning sulphur in the gas chamber unless special apparatus is installed. Sulphur dioxide compressed to a liquid and stored in steel cylinders is available on the market. By using the compressed gas any desired concentration in the chamber within certain limits may be obtained. In winter, when the temperature is too low for dipping, fumigation is feasible if a large number of horses are to be treated and competent men are available to supervise the work. This method apparently has no other distinct advantage over dipping.

Fig. 11.—Exit incline and draining pens of horse-dipping vat

DIPS FOR HORSES

Before approving a dip for use in official dipping one of the requirements of the Bureau of Animal Industry is that there shall be a practical field test for such dip. Of the various classes of dips used on horses, three only are on the approved list—arsenicals, lime-sulphur, and nicotine. Of these the two most commonly used are the lime-sulphur dip for mange and the arsenical dip for lice and ticks.

ARSENICAL DIP

Arsenical dip, when properly used, eradicates biting and sucking lice, but it is not an effective remedy for mange. Prepared arsenical dips have been placed on the market, and those which are permitted by the Government for use in dipping cattle for southern fever ticks are suitable for use in dipping horses, mules, and asses for lice. The instructions on the label of the container should be followed in diluting and using ready-prepared dips. The arsenical dip is not usually warmed or heated in the vat.

It should be remembered that arsenical dip is a poison, and precaution should be taken to prevent injury to man or animal. When it is handled and used with proper care it is a safe and effective remedy. Care should be taken not to get the clothing wet with the dip, and the hands should be washed frequently to prevent possible absorption of arsenic.

Freshly treated animals should be held in the draining pens or other suitable place until all surplus dip has drained off (figs. 11 and 12). If allowed to drain where pools of dip collect from which the animals may drink, or if the pasture or feed becomes soiled with arsenical dip, losses are liable to occur.

If homemade arsenical dip is preferred to the proprietary brands, see United States Department of Agriculture Farmers' Bulletin 603 for full instructions for making it.

LIME-SULPHUR DIP

Proprietary brands of liquid lime-sulphur may be purchased, and many of them are equal to or even better than the homemade product. Manufacturers have also placed on the market a product commonly known as dry lime-sulphur, made by evaporating, *in vacuo* or in the presence of an inert gas, concentrated lime-sulphur solution to which a small amount of cane sugar has been added to act as a stabilizing agent. Dry lime-sulphur is readily soluble in hot water, and it is being extensively used as a dip for animals and as an insecticide for plants. Prepared dips should be diluted and used in accordance with instructions printed on the label of the container. Lime-sulphur dips are efficacious and dependable remedies for mange, but they are not effective against lice and ticks.

Homemade lime-sulphur dip is made in the proportion of 12 pounds of unslaked lime (or 16 pounds of commercial hydrated lime) and 24 pounds of flowers of sulphur to 100 gallons of water. The lime and sulphur should be weighed and the water measured; do not trust to guesswork. Slake the lime in a shallow, water-tight box or tank and add water enough to form a thin paste. Sift the sulphur into the paste and mix well with a broad hoe until a mixture of about the consistence of mortar is formed, adding water as required. Put the mixture into 30 gallons of boiling water, adding it slowly so as not to interrupt the boiling, and boil until the sulphur disappears from the surface. The boiling should be continued for from one and a half to two hours without cessation, and the mixture stirred to prevent settling and caking on the bottom. When the sulphur has disappeared from the surface and the mixture is of a chocolate or dark-amber color, the boiling should be discontinued.

The contents of the boiling tank should be drawn off or dipped out and placed in the settling tank and allowed to stand until all solids have settled to the bottom and the liquid is clear. An ordinary watertight barrel will serve very well for a settling tank at a small vat. A settling tank of any kind should have an outlet at least 4 inches from the bottom, in order that the clear liquid may be drawn off without becoming mixed with any of the sediment.

When the sediment has fully settled draw off the liquid into the dipping vat and add warm water to make a total of 100 gallons of dip. When mixed and cooked as specified above, the concentrate is three and one-third times the strength required for the dip in the vat, so that to every 30 gallons of such concentrate 70 gallons of warm water should be added to make a dip of the required strength.

In preparing lime-sulphur dip in large quantities, several hundred gallons of concentrate are often made at one time in a single

FIG. 12.—Superstructure and draining pen of cage vat

large cooking tank. The quantity made at one boiling is limited only by the facilities at hand. If the boiling tank is of sufficient capacity, a large enough quantity of dip should be cooked at one time to dip the herd. The quantity of mixture in the cooking tank may be varied at will, but the proportions of the various ingredients should not be altered.

NICOTINE DIPS

The nicotine dips sold under various trade names are commonly used for dipping animals and spraying plants for insect pests. They are efficacious remedies for horse lice and mange when diluted with water so that the solution contains not less than five one-hundredths of 1 per cent nicotine. If used much stronger they are liable to injure horses, especially if the animals are dipped while they are warm from exercise or hot weather.

Nicotine dips are generally used warm, but should not be heated above 110° F. The temperature of the bath should be maintained at 90° to 95° F. Sulphur is sometimes added to nicotine dips in the proportion of 16 pounds of flowers of sulphur to 100 gallons of diluted dip. The addition of sulphur increases the effectiveness of the dip for mange and extends the period of protection against reinfestation. These dips should be diluted and used in accordance with instructions printed on the label of the container. Do not use a nicotine dip the strength of which is not given on the label.

COAL-TAR CREOSOTE DIPS

The coal-tar creosote dips, commonly known as coal-tar dips, are sold under many trade names. They are made from coal-tar derivatives, and the principal ingredient is creosote oil, which is

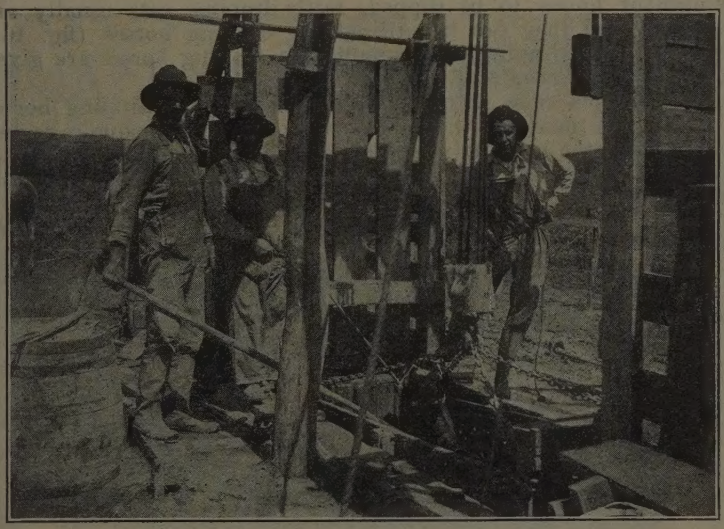

FIG. 13.—Cage vat in operation.

made miscible with water by means of soap. When diluted with soft water they are efficacious in eradicating lice, but they are not dependable remedies for sarcoptic mange.

Before using a coal-tar creosote dip in hard or alkaline water, dilute a small, measured quantity of the dip with the water in the proportion to be used in dipping and place in a clean, glass container. If, after standing for one hour, an oily layer or mass of globules appears either at the top or at the bottom of the liquid, the dip should not be used with that kind of water, as it is liable to injure the animals. Injury may occur even when there is no apparent separation in the dip so tested.

The coal-tar creosote dips may be used cold or warm, but the temperature of the bath should not exceed 95° F. They should be diluted and used in accordance with the instructions printed on the label of the container.

OIL DIPS

Kerosene, crude petroleum, crank-case drainings from gasoline motors, and other oils and greases are commonly used in treating horses for external parasites. When properly used they will eradicate mange and lice, but they often injure horses by blistering the skin and causing the hair to fall out. Oil dips are not recommended for common use in dipping horses.

Cottonseed oil and kerosene, equal parts, or kerosene one-half pint to 1 pound of lard or crude petroleum is often applied by hand to hold mange and lice in check when the weather is too cold for dipping.

DIPPING VATS

In those sections of the United States where there are a large number of horses to be dipped, cattle-dipping vats usually are available, and they can be utilized for dipping horses (fig. 10). Plans of cattle-dipping vats suitable for dipping horses are given in Farmers' Bulletins 1017 and 1057.

The so-called cage vats are sometimes used for dipping horses (fig. 12). In these vats the animal is placed in a movable cage and lowered into the bath by means of a windlass or other mechanical apparatus (fig. 13). The operations are much slower than in the longitudinal vat.

Portable, galvanized-metal vats may be purchased, and they are suitable for dipping a small number of animals. After digging a trench and setting the vat so that the top is flush with the surface of the ground, a chute and slide board should be provided as a means of getting the horses into the vat.

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